

the growth plate closes and a strong intra-articular graft can be placed.

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## The Ilizarov Method

TWENTY YEARS AGO there was a resurgence throughout Europe and the United States in the use of external fixation for the management of fractures and limb deformities. Advancements in materials and techniques have reduced the soft tissue complications previously precluding the use of this method.

Simultaneously in Kurgan, in what was then the Soviet Union, G. A. Ilizarov developed his technique of distraction osteogenesis. This important advancement facilitated limb lengthening, eliminating many of the complications and decreasing the amount of surgical intervention. Ilizarov pioneered the use of a tissue-sparing, cortical osteotomy-osteoclast technique. This technique preserves the osteogenic elements in the limb. Ilizarov advocated a delay of several days before the initiation of distraction to allow the creation of a preliminary callus that could then be lengthened. He perfected the high-frequency, small-step distraction rhythm that permitted good-quality bone to regenerate and decreased soft tissue complications such as nerve and vessel injury.

This technique produces good-quality bone formation, minimizing the prevalence of nonunion (requiring further bone grafting) or premature consolidation of the lengthened segment (requiring osteotomy and osteoclasts to be repeated). Limb-segment lengthening of as much as 140% is now not only possible, but commonplace.

As the Ilizarov methods were learned in Europe and the United States, advancements in materials and external fixator biomechanics quickly modified the technique. This expanded the indications for the treatment of congenital and acquired limb deficiencies. Different external fixation configurations, modifying the ring fixator to uniplanar and biplanar frames and adding transfixion pins and half pins to the wire fixation methods, are now standard.

Complications still interfere with the successful management of limb deficiencies. These complications are predictable enough to have changed the nomenclature in the limb-lengthening literature. Complications that can be treated and do not alter the predicted results are referred to as "problems." Only those complications that alter the predicted outcome are truly "complications." Future trends to improve the Ilizarov method will reduce the complication rate. The goals will be to prevent pin-track

infection and osteomyelitis, premature or delayed consolidation of bone, angular or axial deviation of the regenerate bone, joint contracture or instability, neurovascular compromise, and psychological adjustment reactions.

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## Necrotizing Soft Tissue Infections

NECROTIZING SOFT TISSUE INFECTIONS have recently received substantial publicity in the lay press. These infections present as a variety of clinical, microbiologic, and pathologic syndromes that have received a confusing array of names, including hemolytic streptococcal gangrene, postoperative bacterial synergistic gangrene, Fournier's gangrene, monomicrobial necrotizing cellulitis, nonclostridial anaerobic cellulitis, gram-negative synergistic necrotizing cellulitis, and necrotizing fasciitis.

The hallmark of all these syndromes is infection of the subcutaneous tissue and fascia that produces necrosis, with relative sparing of the muscle. Differentiating between these syndromes clinically is often impossible, and some have suggested abandoning attempts at classification and adopting a common approach to all of them.

Necrotizing soft tissue infection remains a relatively uncommon disease. Although these infections can affect any part of the body, the extremities are most commonly affected. Patients often have underlying diseases, such as diabetes mellitus, injection drug use, chronic alcohol abuse, or peripheral vascular disease. Many cases occur in the postoperative period, especially after an intra-abdominal operation.

Necrotizing soft tissue infections may be due to either a monomicrobial or a polymicrobial process. Although group A streptococci are the most common cause of a monomicrobial infection, other organisms may cause similar syndromes, including *Vibrio vulnificus*, *Clostridium perfringens*, and fungi such as *Rhizopus*, *Mucor*, and *Absidia* species. Polymicrobial infections usually involve a combination of streptococcal species, *Staphylococcus aureus*, members of the Enterobacteriaceae, and anaerobes. Because these infections spread rapidly and are devastating and life-threatening, early diagnosis and aggressive therapy are keys to successful treatment. The difficulty is that, early in their course, necrotizing infections can appear similar to nonoperative cellulitis. Thus, early diagnosis depends on a high index of suspicion for the disease. Clinical signs suggestive of a necrotizing infection include edema that extends beyond the area of skin erythema, the absence of lymphangitis or lymphadenitis, the presence of gas in the soft tissues and skin vesicles, and progression to focal ecchymoses or skin necrosis.

Once the diagnosis of a necrotizing infection is suspected, prompt and aggressive treatment is essential.